Section 2.7 Land Use

Land use analysis of a watershed permits an understanding of the potential for future change through new development and land alteration. A land use analysis examines the actual use of the land (residential homes, commercial businesses, etc.). Pollutants such as metals and toxins from cars, soil from land development and earth moving practices and pesticides and fertilizers applied to lawns can end up in drinking water sources. Assessing the potential impacts that various land uses can have on drinking water is of primary importance when quantifying the health of a

Table 2-18: Croton Bay Watershed Land Use

Land Use Category	Land Use (Acres)	Percent of Watershed
Residential		
R-2A (≥2 ac.)	805	23%
R-1A (.75-1 ac.)	220	6%
R-1/3A (.25-.75 ac)	188	6%
R-1/4A (<.25 ac)	240	7%
R-MF (Multi-family)	55	2%
Non-Residential		
Commercial/Mixed Use	29	<1%
Institution/Cemetery/Religious	169	5%
Manufacturing/Warehouse	10	<1%
Office	37	1%
Transportation General/Utility	201	6%
Open Space		
Private Recreation/Historic	71	2%
Conservation Land	55	2%
Water Supply	76	1%
Park	501	13%
Preserve	179	7%
Water Supply	76	2%
Undeveloped		
Undeveloped	370	11%
Non-Parcel		
Right of Way	83	2%

watershed and determining actions that should be taken to restore and protect drinking water sources.

Parcels in the watershed were categorized into 18 different land uses. In order to provide an overview of land use, the 18 different land uses were placed into four general categories, Residential, Non-Residential, Open Space and Undeveloped. The distribution of the general land uses located in the watershed are identified in

Figure 2-19. Percent impervious surface by land use in the watershed

Land Use	Percent Impervious
Residential	
R-2A	2%
R-1A	3%
R-1/3A	6%
R-1/4A	11%
R-MF	4%
Non-Residential	
Commercial General/Mixed Use	13%
Institution, Cemetery, Religious	3%
Manufacturing/Warehouse	10%
Office	7%
Transportation General/Utility	5%
Open Space	
Private Recreation/Historic	<1%
Conservation Land	<1%
Park	<1%
Preserve	<1%
Water Supply	<1%
Undeveloped	
Undeveloped	<1%

Figure 2-6. As indicated in the figure, the watershed is almost equally residential (45%) and open space and undeveloped (39%).

In order to accurately assess land use in the Croton Bay Watershed a detailed land use classification was created, which combined land use categorized in both the Westchester County 1996 land use and 2004 open space GIS data coverages. The overall structure of the various land use classification system and more detailed information on the land use analysis can be found in Supplement B: Methodologies.

The land use categories that fall within each of the general land use groupings can be found in Table 2-7. Table 2-7 also includes the total acreage and percent coverage for each land use found in the Croton Bay Watershed. Figure 2-7 is a land use map of Croton Bay Watershed.

Impervious surface was also calculated based on the 2000 Westchester County data for each land use (for details on the calculations of impervious surfaces refer to Supplement B).

Figure 2-20: General land uses found in the Croton Bay Watershed

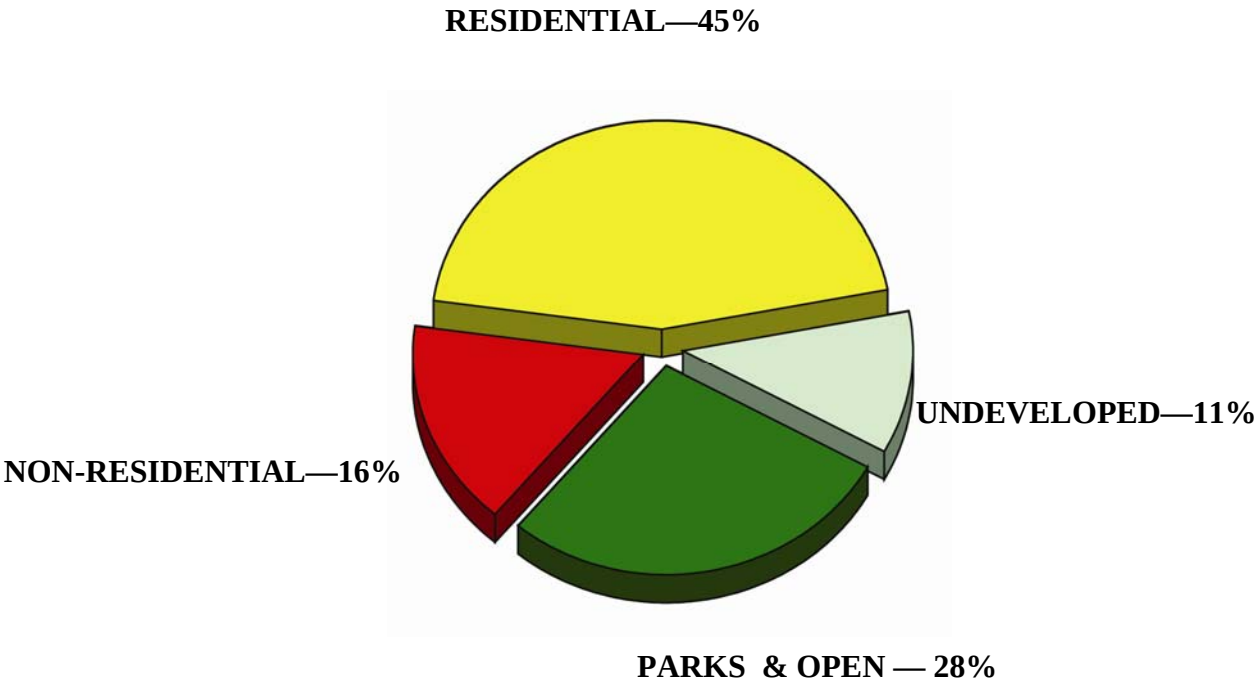
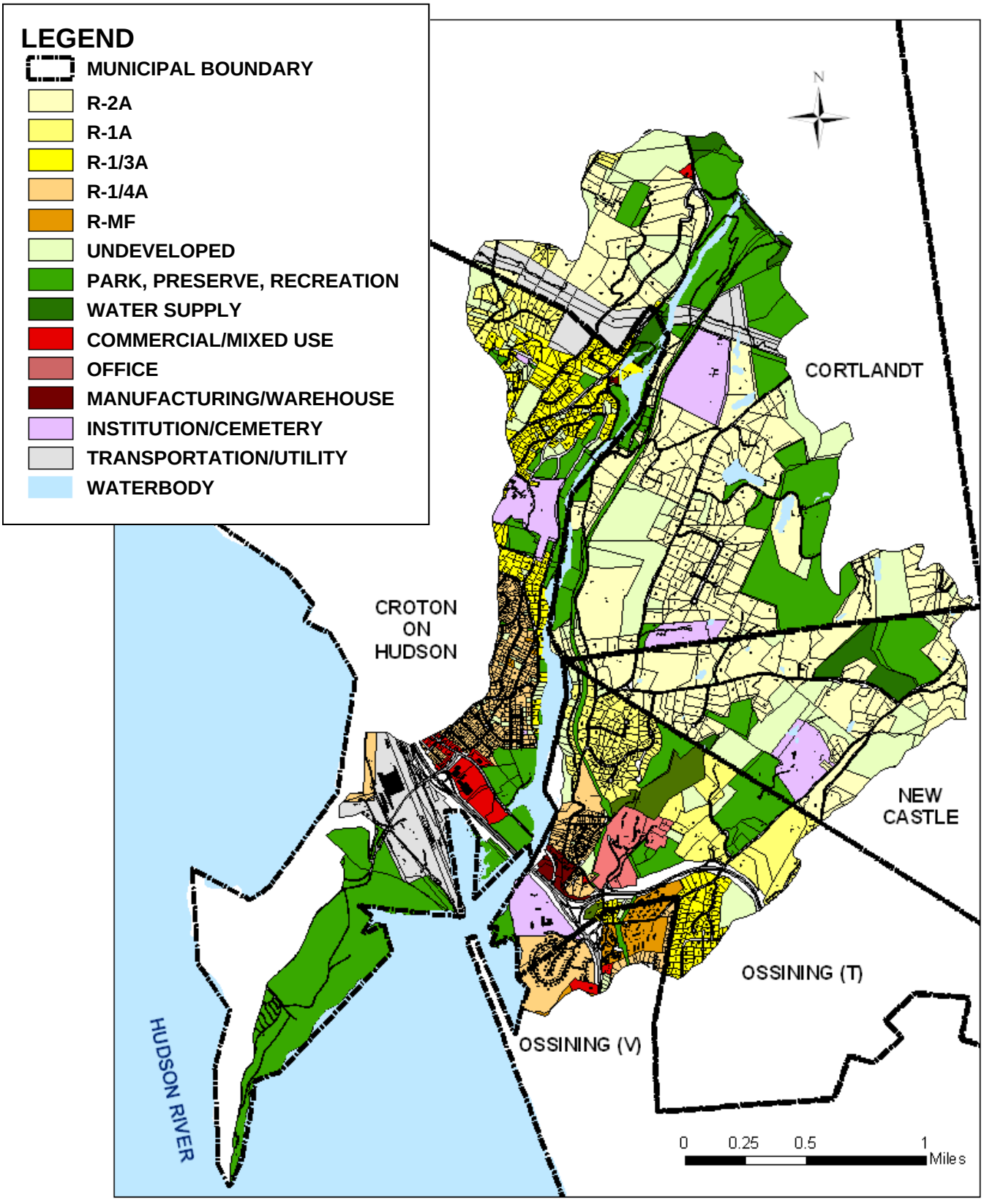


Figure 2-21: Map of general land uses found in the Croton Bay Watershed



RESIDENTIAL

Residential development is the most dominant land use throughout the watershed with 43 % characterized as residential. The five residential categories were created based on acreage: R-2A, R-1A, R-1/3A, R-1/4A and R-MF (refer to Table 2-7). Figure 2-8 illustrates the distribution of the residential land uses found in the watershed. Large homes on large properties are common in the watershed and found mainly in unsewered areas of the watershed. Denser development is found in the sewered areas of the watershed.

Figure 2-22. Typical R-2A single family home

Figure 2-23. Residential housing in Ossining.

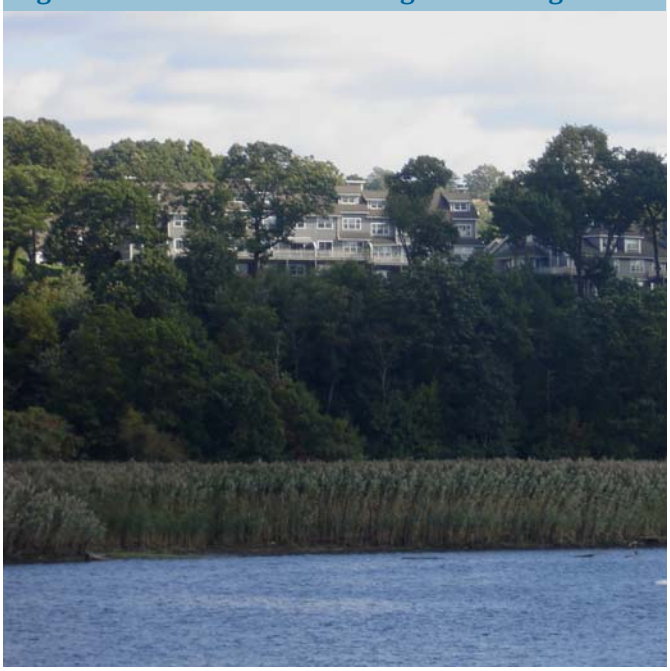
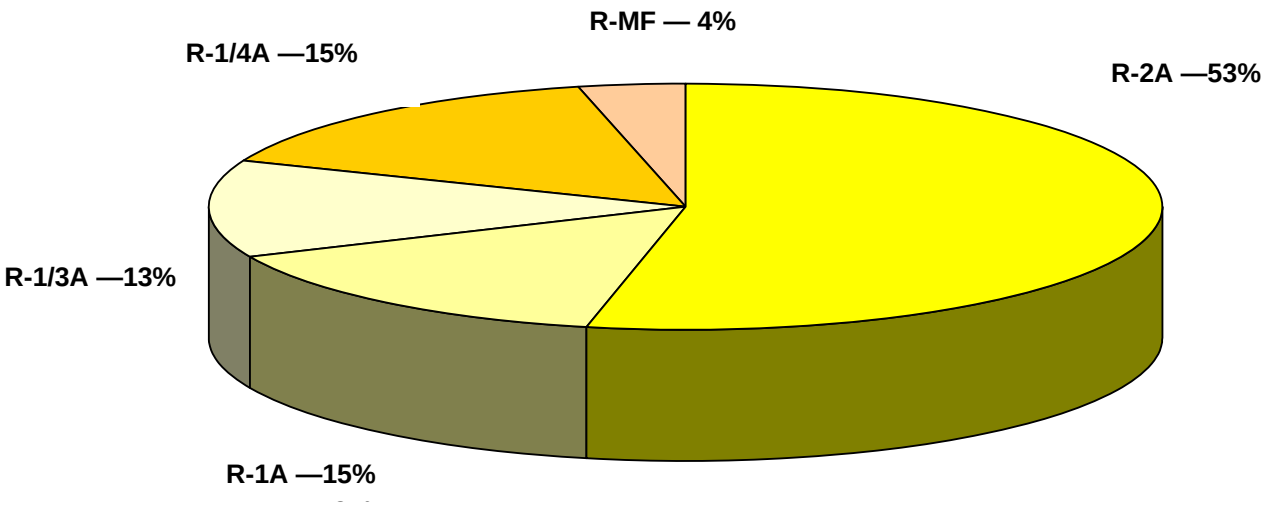


Figure 2-24: Distribution of residential land uses in the Croton Bay Watershed



NON-RESIDENTIAL

Non-Residential is the third largest general land use found in the watershed, making up 16% of the total watershed (refer to Figure 2-6). There are nine categories in the watershed under this heading that vary greatly in intensity of land use activities (refer to Table 2-7). Transportation and utility uses are the most prevalent non-residential land uses in the watershed due to the location of the Metro-North's Croton Harmon Station. Figure 2-9 displays the distribution of the non-residential land uses found in the watershed.

Figure 2-25. Distribution of non-residential land uses in the watershed

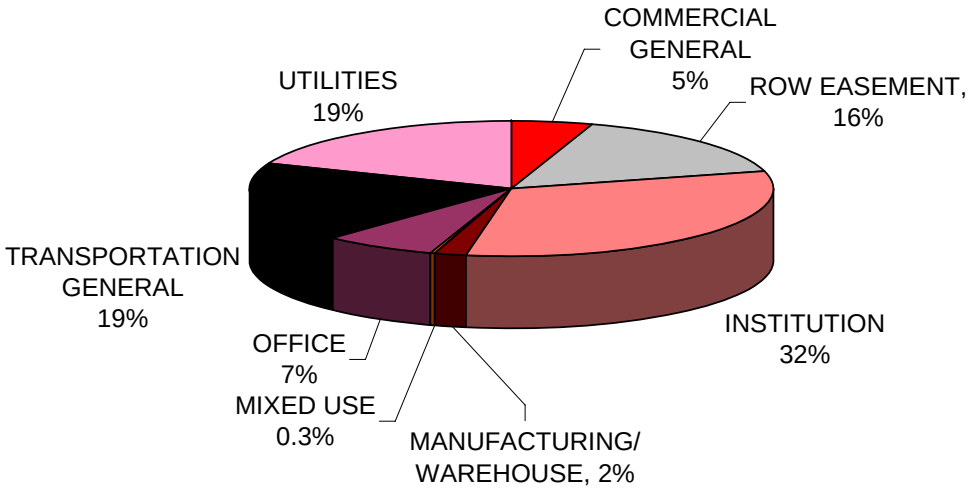


Figure 2-26. Commercial shopping center, Croton

Figure 2-27. Municipal Garage, Croton

OPEN SPACE:

Approximately 28% of the watershed can be classified as open space (refer to Figure 2-6). There are six categories of open space divided by the actual use of the land (refer to Table 2-7). This general land use group is the second largest land use group, after residential, in the watershed. As of 2004, there were 0.51 acres of open space for each one acre of residential use. Open space also includes a number of different land uses that are considered desirable land uses for environmental, recreational, wildlife and economic benefits. Figure 2-10 displays the distribution of the open space land uses found in the watershed.

UNDEVELOPED LAND

Approximately 11% of the Croton Bay Watershed consists of parcels that are undeveloped and are considered vacant land (refer to Figure 2-6). Undeveloped land has not been preserved as open space and is open for development and can be publicly or privately owned.

Figure 2-28. Croton Point Park, Croton

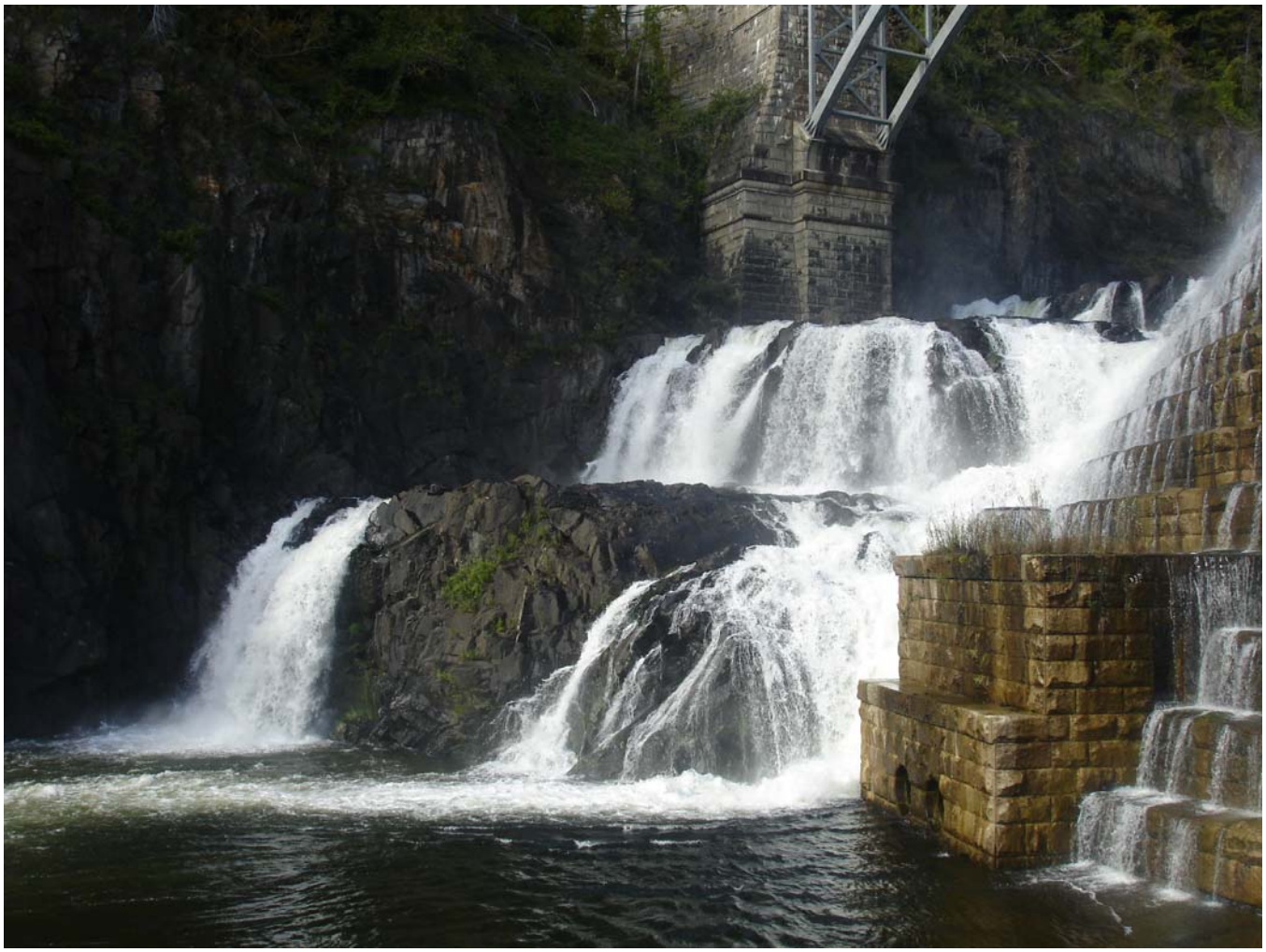
A. TOWN OF CORTLANDT

The Town of Cortlandt encompasses almost 35 square miles in northern Westchester. Although only 6% of the Town of Cortlandt is located in the Croton Bay Watershed, Cortlandt makes up 38% of the watershed. Cortlandt's area of the watershed is primarily large lot residential characterized by single family homes on parcels at least double the size found elsewhere in watershed.

Forty-two percent of the watershed in Cortlandt can be classified as steep slopes. In Cortlandt, steep slopes greater than 25% are primarily found adjacent to the Croton River where the parcels are generally residential or open space.

The Indian Brook Reservoir and its tributaries are very important environmental assets to the watershed. The Indian Brook Basin in Cortlandt is not fully developed. Any additional development could adversely impact water quality, especially without the utilization of stormwater best management practices. Such practices include measures such as leaf collection. Cortlandt has a leaf collection program and currently all leaf collection is done in the fall.

Figure 2-28. Croton Dam Falls, Cortlandt, New York



Many residents in Cortlandt are on private well water and no government monitoring exists for private wells. It is the homeowner's responsibility to monitor their water. Cortlandt has attempted to provide groundwater quality protection in the watershed through an overlay zone but the current provision does not provide adequate protection for groundwater drinking water sources.

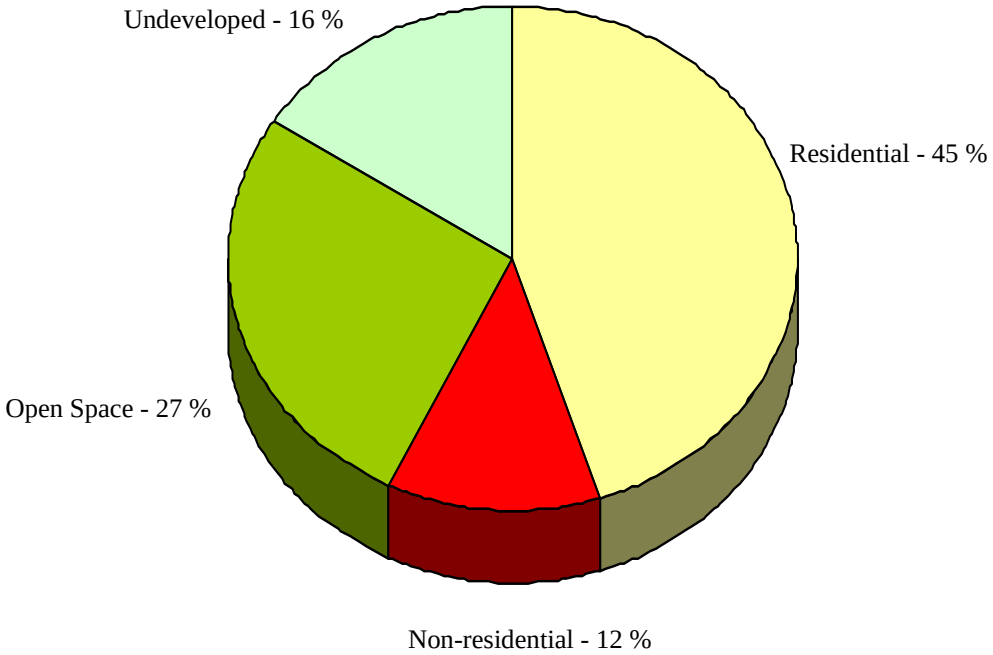
Cortlandt currently has environmental regulations that could potentially help to improve and protect water quality in the watershed. These regulations are included in the ordinance review and can be found in Supplement A: Additional Resources. The Town will be participating in Westchester County's EPA Phase II Stormwater Regulations Public Education and Outreach Program funded through NYS Environmental Protection Fund supported by the NYS DEC.

Cortlandt within the watershed is not sewered and no required monitoring of septic systems for proper functionality exists and malfunctioning septic systems could be a potential source of groundwater contamination.

A majority of the road runoff in Cortlandt's share of the watershed discharges into roadside swales. Properly constructed and maintained swales can be an environmentally friendly application to direct the flow of stormwater runoff. Many roadside swales in the Town, however, are not protected by vegetation or riprap and experience great amount of erosion. The erosion in the swales leads to structural instability of the road sides and increase in sedimentation in the receiving waterbody. In Cortlandt, the major area of concern exists along Quaker Bridge Road.

Outfalls in the Town discharge directly into the Croton River. Upon investigation,

Figure 2-29. Town of Cortlandt Land Use in the Croton Bay Watershed



the stormwater did not appear to be pretreated. Many outfalls discharge onto steep slopes causing the slopes to erode. The high rates of destructive erosion from stormwater discharges can lead to structural instability of the slopes and increase sedimentation of the Croton River.

CORTLANDT LAND USE SUMMARY:

Land in Cortlandt's area of the watershed is typified by large lot residential and open space. No hamlet area or commercial center exists. The residential areas are characterized as being semi-rural character. Route 129 is the only major road that goes through Cortlandt's area of the watershed. Croton Gorge Park, a County Park, is one of the largest uses of land as is the Danish Home, a retirement home for people of Danish Descent. The Danish Home practices organic gardening as a recreational activity for the residents. Figure 2-29 details the land use in Cortlandt's section of the watershed.

Undeveloped

Sixteen percent of the land area in Cortlandt is undeveloped, with the largest contiguous parcels of undeveloped land located between the Croton Aquifer and Quaker Bridge Road. If this land were developed, it could impact the water quality of the watershed by increasing impervious surfaces and stormwater runoff.

Nature Preserve, Parks and Conservation Land

Twenty-three percent of the land in Cortlandt consists of nature preserves, parks and conservation land. The largest park located in the Croton Bay Watershed is the Westchester County Croton Gorge Park, the site of the New Croton Dam which is National Register Landmark property.

Figure 2-30. Open Space in Cortlandt, New York

Non-residential

Institutional properties make up 5% of the total land area in Cortlandt and most parcels are underdeveloped. Institutional lands are approximately covered by 7% with impervious surfaces. If institutional land is developed to the fullest potential, impervious surface and the total stormwater runoff will increase.

R-2A: Lots of 2 Acres or Greater

A large portion of the R-2A district in Cortlandt does not have stormwater infrastructure. Sheet flow serves as the primary transportation method for stormwater runoff. If there is enough pervious surface for the water to infiltrate and water is not directed down steep slopes, sheet flow should not be a major concern. However, if development is to increase, flooding and pollutant loading from untreated stormwater runoff can become a major water quality issue. The primary areas of sheet flow concern are near the Croton River and waterbodies.

Figure 2-31. Typical R-2A land use in Cortlandt

B. VILLAGE OF CROTON ON HUDSON

The Village of Croton-on-Hudson's (Croton) area totals 3,056 acres of which 30%, 918 acres, is located in Croton Bay Watershed. Croton's portion of the watershed is only located only in Croton Gorge Basin, but encompasses the second largest area, 26 %, in the watershed by municipality. Figure 2-32 details Croton's land use in the watershed.

Croton's sole source of water comes from a drinking water aquifer. The Croton River is an important environmental asset not only to the watershed, but also to Croton aquifer. The river currently receives discharges from stormwater outfalls and sheet flow. A delicate ecosystem in the river and potential interaction between the river and Croton aquifer exists. Improving and monitoring the water quality of Croton River and determining how the flow regime affects the wildlife in Croton River corridor is important to protect the delicate balance of the river and aquifer.

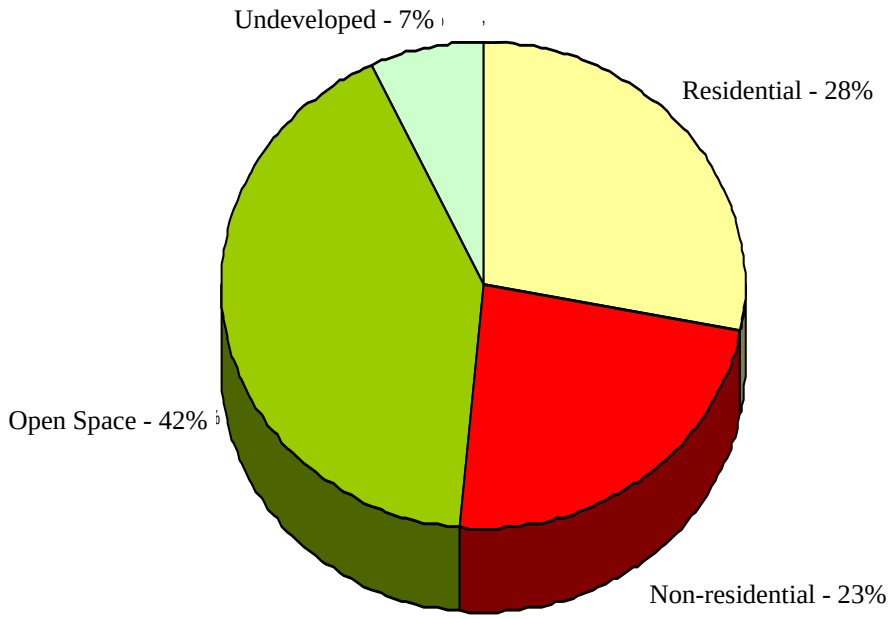
Additionally, it is very important that the Village maintain and monitor a sufficient buffer adjacent to the well fields to safe guard against contamination.

Wetlands in Croton have become degraded over the years as a result of invasive species. The greatest areas of concern are the tidal wetlands located along the Route 9/9A corridor. Eleven percent of Croton Bay Watershed soils are classified as hydric, a wetland indicator, although only 7% of the entire watershed is designated as wetland. Wetlands not identified by the federal or state government could therefore have the potential to become designated wetlands of local significance and some are located in Croton are in Croton Point Park and along Croton River. Twenty-two percent of Croton contains steep slopes. Most of the steep slopes are concentrated along Croton River and in developed areas.

The Village has a stormwater public information display, developed village stormwater newsletter inserts and will be participating in Westchester County's EPA Phase II Stormwater Regulations Public Education and Outreach Program funded through NYS Environmental Protection Fund supported by the NYS DEC. Croton currently has environmental regulations that help improve and protect water quality in the watershed. An ordinance review was conducted and can be found in Supplement A: Additional Resources.

Stormwater problem area investigations were conducted in Croton using site reconnaissance techniques. Currently, all stormwater runoff from Route 9/9A drains directly from the roadways discharging into Croton Bay. The Shop Rite Shopping Center, located on Riverside Avenue, has a large parking lot with little pervious surface. Sediments can be found throughout the parking lot that directly drain into

Figure 2-32. Village of Croton Land Use in the Croton Bay Watershed



the catch basins during each rainstorm. Currently no stormwater practices are being conducted in this area. Besides parking lot pollutants, dumpsters and other waste disposal containers exist which, if not properly maintained, could also contribute to stormwater runoff pollutants. Untreated runoff from the shopping center runs underneath Route 9/9A and into Croton Bay.

Land Use in Croton

The watershed slices through the Village of Croton taking in the full spectrum of land uses found throughout the Village. Croton is the most urbanized area within the watershed.

Residential

Twenty eight percent of the total land area in Croton is zoned for residential. Residential land use contributes to a majority of the nonpoint source pollution in Croton. The nonpoint source pollution comes from common activities in residential areas such as lawn care, car washing, pet fecal material and waste disposal.

Undeveloped

Seven percent of the total land area in Croton is undeveloped. Most of the undeveloped land is scattered throughout the Village, but found mostly in residential areas. Undeveloped parcels have a potential for development and if developed, may impact water quality of watershed due to an increase in impervious surfaces and stormwater runoff.

Parks and Conservation Land

Approximately 35% percent of the total land in Croton can be classified as historic, nature preserves, parks or conservation. A majority of this land is zoned for residential uses. A concern does not really exist for residential development but the potential increase of impervious surfaces by the existing land uses such as Croton Point Park or Van Cortlandt Manor.

Figure 2-33. Shop-Rite Plaza, Croton-on-Hudson, New York

Institution

Institutional land uses, which compose 4% of the total land area in Croton, are typically underdeveloped and are about 7% impervious. A potential exists under current regulations for further development of these properties and if further developed the total impervious surface and stormwater runoff will increase.

Nonresidential

Commercial and transportation uses comprise approximately 16% of Croton. Although nonresidential land uses are a small percentage of the total land area in Croton, nonresidential land uses typically have large areas of impervious surfaces and onsite activities that could degrade water quality. If stormwater from these parcels is not properly controlled and treated, these parcels have the potential to contribute significant pollutants into watershed. Major areas of concern are the shopping center located behind 9/9-A, Metro-North train station and Route 9/9-A.

C. TOWN OF NEW CASTLE

New Castle is approximately 26 square miles and about 3 % of the town is located in the watershed and almost entirely located in the Indian Brook Basin. The town comprises 15% of the watershed and similar to Cortlandt, most of town's watershed consists of single family homes on large lots.

Glendale wetland in New Castle is the largest and only upland NYS DEC designated wetland in the watershed. Steep slopes are found throughout the Town, primarily located on undeveloped and underdeveloped parcels. New Castle currently has environmental regulations to help improve and protect water quality. An ordinance review was conducted for the municipalities in the Croton Bay Watershed and can be found in Supplement A: Additional Resources.

The Town of Ossining wells are located on a large parcel in New Castle and some residents in the town rely on private well water for drinking water. New Castle has attempted to provide groundwater quality protection in the watershed through overlay zoning. New Castle has established an overlay zone to protect the Indian Brook Reservoir, but the restrictions are limited and pertain mostly to wetland buffers. Stormwater runoff flows as sheet flow towards the reservoir and reservoir tributaries. Current ordinance provisions do not provide adequate protection for all groundwater drinking water sources. Any additional development may have an adverse affect on the Indian Brook Reservoir water quality, especially if certain stormwater management practices are not instituted. Land surrounding the Indian Brook Reservoir in New Castle does not contain stormwater infrastructure.

Figure 2-34. Glendale Wetland, New Castle, New York

New Castle has an existing catch basin cleaning program. Most catch basins are cleaned once every year. To date, the sanitary sewers in the Town of New Castle have not been mapped and there is no official illicit discharge program in place. The town currently has a street sweeping program with streets swept twice a year by mechanical sweepers. The town participates in the Westchester County Household Hazardous Waste Collection Program and informs their residents of the program through informational mailings. No town leaf collection program in place. New Castle currently has no road salt management program or policies regarding snow disposal.

New Castle has education and outreach programs concerning stormwater which includes a section in the town's newsletter called Conservation Notes. The Town will also be participating in Westchester County's EPA Phase II Stormwater Regulations Public Education and Outreach Program funded through NYS Environmental Protection Fund supported by the NYSDEC. .

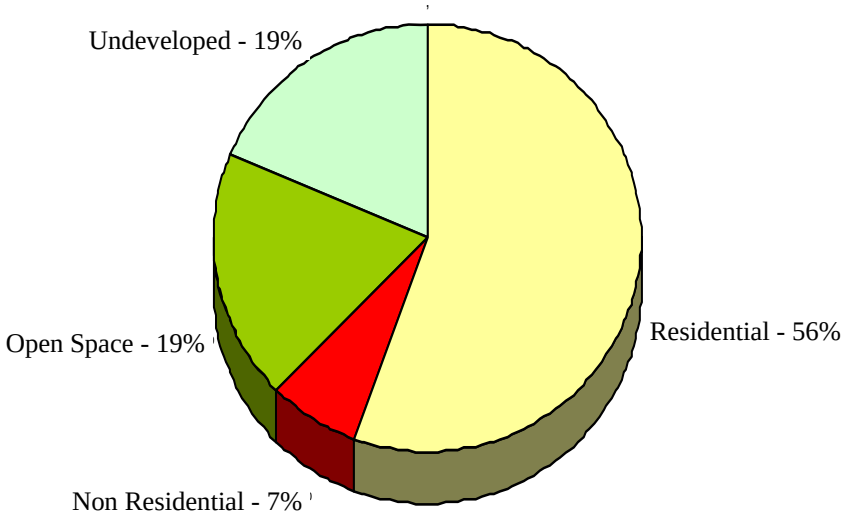
Land Use

Land in New Castle's area of the watershed can be typified similarly to that in the Town of Cortlandt, by large lot residential and open space. No hamlet area or commercial center exists. The residential areas are characterized as being semi-rural character, but no major roads pass through the town. Figure 2-35 details the land use in New Castle's section of the watershed.

Residential

Forty-eight percent of the watershed area in New Castle is zoned R-2A, two-acre residential. Eight percent of the watershed area in the town is zoned for R-MF, multi-family housing. Residential property impervious surface is only 7%, but residential land use generates a majority of the nonpoint source pollution found in New Castle. Also, many parcels found in R-2A zoning districts are underdeveloped and

Figure 2-35. Land Use in New Castle in the Croton Bay Watershed.



have a greater potential for development. Redevelopment in areas surrounding the Indian Brook Reservoir could potentially degrade water quality.

Undeveloped

Nineteen percent of the watershed area in New Castle is undeveloped. If the undeveloped land becomes developed it could potentially impact water quality in the watershed due to increases in impervious surface and thus stormwater runoff. Specific areas of concern include undeveloped properties surrounding the Indian Brook Reservoir.

Open Space

Approximately 12% of the watershed area in New Castle consists of nature preserves and parks. Proper management of preserve and park land adjacent to the Glendale wetland is considered to be of great importance for water quality protection.

Non-residential

Institutional land comprises 7% of the watershed in New Castle and is also underdeveloped. Currently, institutional land uses are covered with approximately 7% of impervious surfaces. If the institutional land uses are developed to the full potential the total impervious surfaces and associated stormwater will increase. New Castle has one of the largest institutions, the Asthmatic Children's Foundation of New York, in the watershed.

Figure 2-36. Asthmatic Children's Foundation of New York, Town of New Castle

D. TOWN OF OSSINING

The Town of Ossining has an area of 1,940 acres of which 29%, approximately 570 acres, are located in the watershed. The town has the third largest area in the watershed and is located in both the Indian Brook and Croton Gorge Basin. Figure 2-38 is shows the distribution of land use in the watershed.

Wetlands in the Town of Ossining consist of small Federal National Wetland Inventory (NWI) wetlands and one NYS DEC tidal wetland. The Indian Brook Reservoir and its tributaries are important environmental assets to the watershed. Underdeveloped land surrounds the Indian Brook Reservoir and if certain stormwater management practices are not instituted prior to development, any additional development could potentially degrade water quality in the Indian Brook Reservoir.

Twenty-three percent of the Town of Ossining can be classified at steep slopes. Steep slopes are found throughout the Town but tend to be concentrated along the Croton River and the Indian Brook Reservoir. Many of the steep slopes are located in areas that are already developed. If the land were to continue to be developed, increased erosion might result from an increase in stormwater runoff.

The Town of Ossining has environmental regulations that potentially can improve and protect water quality in the watershed. An ordinance review was conducted and can be found in Supplement A: Additional Resources. The town has not

Figure 2-37. View of Croton Bay from St. Augustine's Cemetery, Town of Ossining, New York

mapped stormwater infrastructure, catch basins and outfalls.

The Town of Ossining has a drinking water reservoir and it is important for the Town to maintain a buffer around the reservoir and provide that necessary storm-water management practices are instituted to protect water quality.

The Town of Ossining currently has education and outreach programs concerning stormwater consisting of informational mailings and a booth at the Village/Town of Ossining Fair. The town will also be participating in the Westchester County's EPA Phase II Stormwater Regulations Public Education and Outreach Program funded through NYS Environmental Protection Fund supported by the NYSDEC. The town participates in Westchester County's Household Hazardous Waste Collection Program and informs residents of the program by mail.

The town's current stormwater practices consist of catch basing cleaning, leaf collection and street sweeping. The Town of Ossining has an existing public catch basin cleaning program and most areas are cleaned annually with known problem areas being cleaned as necessary. The Town of Ossining collects leaf debris collection is done in the fall and in early winter by using a vacuum. Streets are usually swept by a Town-owned street sweeper four times per year. The Town of Ossining currently does not have a road salt management program or policies regarding snow disposal but all road salt is stored in a covered building.

Stormwater problem area investigations were conducted using site reconnaissance techniques with the town. Areas of concern were identified in the field:

Outfalls to Croton Bay and River

Untreated stormwater outfalls in the Town discharge directly into the Croton Bay and a often the discharge is on steep slopes causing erosion. The high rate of erosion creates both structural instability of the slopes and increased sedimentation of the bay. Stormwater outfalls of concern are located at St. Augustine's cemetery and Mystic Point condominiums.

Roadside Swales

A majority of the road runoff in the Town of Ossining discharges into roadside swales not protected by vegetation or riprap. The roadside swales are experiencing significant erosion that is creating structural road side instability and increasing sedimentation into the water. A major area of concern is located along Quaker Bridge Road.

Route 9/9A

Currently, all stormwater runoff from Route 9/9A drains directly from the roadways discharging into the Croton Bay. The stormwater is untreated and likely contributing pollutants into the Croton Bay.

Town of Ossining Land Use

Land use in the town's area of the watershed is typical for the Town of Ossining. The town is primarily residential with the exception of a few non-residential uses on large lots.

R-1/3A

Thirty-one percent of the Town of Ossining within the watershed is zoned for 1/3-acre lots and covered with 9% impervious surfaces. Many lots are underdeveloped with the potential for further development which could possibly lead to increase impervious surfaces and stormwater runoff. R-1/3A parcels surround the Indian Brook Reservoir in the town.

Undeveloped and Open Space

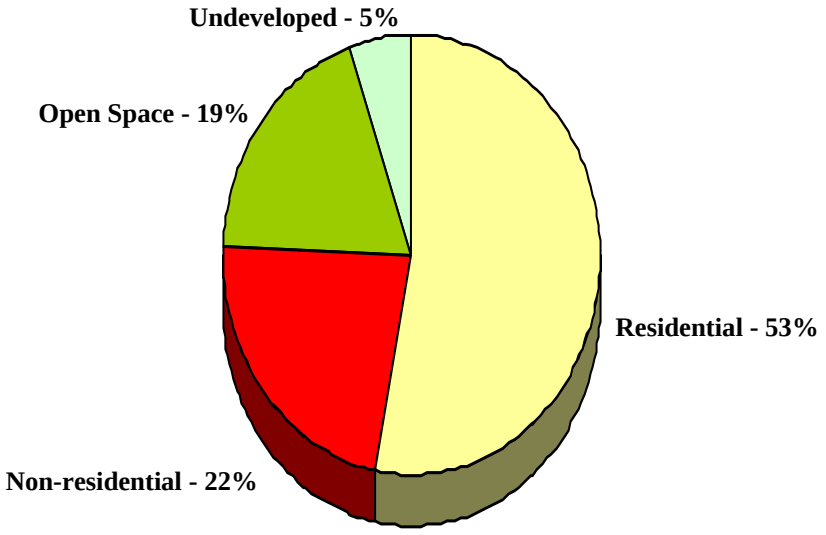
Five percent of the total land area in the Town of Ossining is undeveloped. Twelve percent of town in the watershed consists of nature preserves and parks.

Non-Residential

Office use comprises 7% of the total land area in the Town of Ossining and is also underdeveloped by current zoning standards. Currently, Office use consists only of the General Electric campus of which 16% is covered with impervious surfaces. If this parcel is developed to its fullest potential the total amount of impervious surface would potentially increase. The General Electric campus is also located adjacent to the Indian Brook Reservoir.

Approximately 11% of the Town of Ossining's land is Manufacturing or Warehouse. Although they do not make up a majority of the land area in the Town, the percentage of impervious surfaces is 15% and activities are associated with these uses that possibly generate polluted runoff.

Figure 2-38. Town of Ossining Land Use in the Croton Bay Watershed



E. VILLAGE OF OSSINING

The Village of Ossining area is 2, 036 acres of which 5%, approximately 99 acres is located in the Croton Bay Watershed. The Village of Ossining has the smallest land area of all municipalities in the watershed (3%) and is solely located in the Indian Brook Basin.

The Indian Brook Reservoir provides drinking water for the Village and even though the reservoir is located in the Town of Ossining it is owned by the Village. The Village is serviced by a sewer system that is treated at the County's Waste Water treatment facility located next to Sing Sing Correctional Facility in the Village.

Thirty-three percent of the Village of Ossining is classified as steep slopes. Steep slopes are found throughout the Village. Many of the steep slopes are located in developed areas. The Village of Ossining currently has environmental regulations that help improve and protect water quality in the Croton Bay Watershed. An ordinance review was conducted and the regulations can be found in Supplement A: Additional Resources.

The Village of Ossining currently has a street sweeping program for public streets. The Village has mapped stormwater infrastructure and will be participating in the Westchester County's EPA Phase II Stormwater Regulations Public Education and Outreach Program funded through the NYS Environmental Protection Fund supported by the NYSDEC.

The Village of Ossining has stormwater outfalls that discharge directly into the Croton Bay. The stormwater is not pretreated and often discharge occurs onto steep slopes causing erosion. The high rate of erosion on the slopes cause both structural

Figure 2-39. Indian Brook Reservoir, Town of Ossining, New York

instability of the slopes and increased sedimentation of the bay.

Currently, all stormwater runoff from Route 9 drains directly from the roadways and discharges into the Croton Bay. The stormwater is untreated and is most likely contributing many different types of pollutants to the Croton Bay.

Land Use in the Village of Ossining

Ninety four percent of the total area of the watershed in the Village of Ossining is zoned residential. Twenty-six percent of the residentially classified land in the Village of Ossining is covered with impervious surfaces and contributes a majority of the nonpoint source pollution found in the Village of Ossining. The nonpoint source pollution comes from common activities performed in residential areas such as lawn care, car washing and pet waste. Four percent of the watershed in the Village is classified as Open Space and 2% is classified as Non-residential.

Figure 2-40. Mystic Pointe, Village/Town of Ossining (photo credit Ginsburg Development Corporation)